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10/614,535	07/07/2003	Donald K. Mitchell	MICRE-012XX	9121

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EXAMINER	
WILLIAMS, DON J	

ART UNIT	PAPER NUMBER
2878	

DATE MAILED: 06/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/614,535	MITCHELL, DONALD K.	
	Examiner	Art Unit	
	Don Williams	2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07/07/2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the Applicant's application filed on July 7, 2003.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee et al (5,991,249).

As to claim 1, Lee et al disclose a quasi-monochromatic light source (102) disposed on a surface of a planar substrate (104) facing the encoder scale (107); a plurality of optical detectors (103) and (400) with detector elements (404), (405), and (406) disposed on the surface of the substrate at respective locations defining respective optical paths between the optical detectors (103), and (400) with detector elements (404), (405), and (406) and respective tracks (periodic tracks) with track of marks (302), (column 3, lines 37-38) of the encoder scale (107); and an optical wavefront dividing element (12) disposed between the substrate and the encoder scale (107), the optical wavefront dividing element (12) being operative to divide an incident light beam (105) produced by the light source (102) into a plurality of diffracted light beams (106), each diffracted light beam (106) being directed toward a respective track of the encoder scale (107) at a respective angle so as to be reflected from the

respective track with track marks (302) along the optical path to the respective detector (103) and (400) with detector elements (404), (405), and (406), (see Abstract, fig. 1, column 1, lines 24-65, fig. 2, fig. 3, column 3, lines 27-53, column 4, lines 4-41).

As to claim 2, Lee et al disclose the quasi-monochromatic light source (102) comprises a vertical cavity surface emitting laser (VCSEL) or (LED), (see Abstract, fig. 1, column 1, lines 24-26, fig. 2, column 3, lines 27-37).

As to claim 3, Lee et al disclose the quasi-monochromatic light source (102) emits an expanding cone of light, (see fig. 2, column 2, lines 11-31, column 3, lines 27-35).

As to claim 4, Lee et al disclose the plurality of optical detectors (103) and (400) with detector elements (404), (405) and (406) include two detector optical detectors (404) and (405) disposed on opposite sides of the light source (401), (see fig. 4, column 4, lines 5-41).

As to claim 5, Lee et al disclose wavefront dividing element (12) comprises a diffractive optical element (DOE) disposed on a second substrate, (see fig. 1, column 1, lines 24-67.

As to claim 6, Lee et al disclose DOE (diffractive optical element) (12) comprises a layer of material having a thickness selected to introduce a substantially half-wave delay derived from equation ($Z\Phi = 4N^*T^2/WAVE$) in light (105) passing through the DOE (12), (see fig. 2, column 3, lines 46-66, column 4, lines 1-4, fig.4, column 4, lines 5-41).

As to claim 7, Lee et al disclose the DOE comprises a grating having a square wave profile, (see column 4, lines 42-47).

As to claim 8, Lee et al disclose the DOE comprises a grating having a triangle wave profile (510) and (512), (see fig. 5, column 4, lines 42-49).

As to claim 9, Lee et al disclose DOE comprises a grating having a sine wave profile (610) and (612), (see fig. 6, column 4, lines 50-57).

As to claim 10, Lee et al disclose the second substrate further includes a plurality of windows, each window (402) lying along a corresponding one of the optical paths (106) between the tracks of track marks (302) on the encoder scale (107) and the detectors (103) and (400) with detector elements (404), (405) and (406), (see fig. 2, fig. 3, column 3, lines 27-65, fig. 4, column 4, lines 5-40).

As to claim 11, Lee et al disclose a second substrate comprises a substantially optically transparent material (302), (304), (412) and (414) having a low coefficient of thermal expansion, (see fig. 1, column 1, lines 54-61,fig. 4, column 4, lines 5-41).

As to claim 12, Lee et al disclose the second substrate is coated with optically transparent material (302), (304), (412) and (414) having an index of refraction n different from that of air, (see fig. 1, column 1, lines 54-61, fig. 2, column 3, lines 35-50, fig. 4, column 4, lines 5-25).

As to claim 13, Lee et al disclose the optically transparent material (302), (304), (412), and (414) comprises a dielectric material (107), (see fig. 2, fig. 3, column 3, lines 27-65, fig. 4, column 4, lines 5-42).

As to claim 14, Lee et al disclose dielectric material (107) has a refractive index close to the refractive index of the second substrate, (see fig. 2, column 3, lines 27-65).

As to claim 15, Lee et al disclose a sensor head (104) including a substrate and beam divider (12), the beam divider including an optical wavefront dividing element (13) and (17), the substrate having a light source (11) or (102) and first and second optical detectors (18), or (103), or (400) with detector elements (404), (405) and (406) disposed thereon; an encoder scale (107) including first and second tracks of track marks (302), the encoder scale (107) being disposed opposite the sensor head (104) with the beam divider (12) therebetween such that a light beam (105) emitted by the light source (11) or (102) is incident on the wavefront dividing element (12), the wavefront dividing element (12) being operative to divide the incident beam (105) into first and second beams (105) and (106) being substantially incident on the first and second tracks of track marks (302) of the encoder scale (107) respectively, light from the first beam (105) being reflected and diffracted by the first track to the first optical detector, and light from the second beam (106) being reflected and diffracted by the second track to the second optical detector (18), or (103), or (400) with detector elements (404), (405) and (406); and a signal processor (404) and (405) operative to interpret signals (S1) and (S2) from the first and second detectors (18), (103), and (400), (see fig. 1, column 1, lines 24-67, fig. 2, fig. 3,column 3, lines 27-66, fig. 4, column 4, lines 5-41).

As to claim 16, Lee et al disclose a sensor head (104) including a substrate having a light source (11) or (102) and first and second optical detectors (18), (103), (400) with detector elements (404), (405), and (406) disposed thereon; and encoder scale (107) including first and second tracks with track of marks (302); and a wavefront dividing element (12) disposed between the sensor head (104) and the encoder scale

(107), the wavefront dividing element (12) being operative to divide an incident light beam (105) emitted by the light source (11) or (102) into first and second beams (105) and (106), the first beam (105) being incident on the first track (302) of the encoder scale (107), the second beam (106) being incident on the second track (302) of the encoder scale (107), light from the first beam (105) being reflected and diffracted by the first track (302) to the first optical detector (18), or (103), or (400) with detector elements (404), (405) and (406), light form the second beam (106) being reflected and diffracted by the second track (302) to the second optical detector (18), or (103), or (400) with detector elements (404), (405), and (406), (see fig. 1, column 1, lines 24-67, fig. 2, fig. 3, column 3, lines 27-66, fig. 4, column 4, lines 5-41).

As to claim 17, Lee et al disclose a wavefront dividing element (12) is disposed on a substrate of the beam divider disposed between sensor head (104) and the encoder scale (107), (see fig. 1, column 1, lines 24-67, fig. 2, fig. 3, column 3, lines 27-45).

As to claim 18, Lee et al disclose the substrate of the beam divider (12) is fixed relative to the substrate of the sensor head (104), (see fig. 1, column 1, lines 24-27), (see fig. 2, column 3, lines 26-37).

As to claim 19, Lee et al disclose the substrate of the beam divider (12) and the substrate of the sensor head (104) are fixed into a single monolithic construction, (see fig. 1, column 1, lines 24-67, fig. 2, column 3, lines 27-45).

As to claim 20, Lee et al disclose the encoder (101) including a scale (107), the scale (107) being movable relative to the sensor head (104) along a first axis, a

distance (Z_Φ) or (Z_1) between the scale (107) and the sensor head (104) as measured in a direction substantially perpendicular to the first axis being substantially constant, the encoder (101) generating a signal (S1) and (S2) representative of a position of the scale (107) relative to the sensor head (104), the scale (107) including a first track (302) and a second track (302), the sensor head (104) comprising a substrate, a light source (11) or (102), a first optical detector (18), (103) or (400) with detector elements (404), (405), and (406), a second optical detector (18), (103), or (400) with detector elements (404), (405), and (406), and a beam divider (12) including an optical wavefront dividing element (12), the light source (11) or (102) being disposed on the substrate, the beam divider (12) being spaced apart from and fixed relative to the substrate, an emitted light beam (105) emitted from the light source (11) or (102) being incident on the wavefront dividing element (12), the wavefront dividing element (12) dividing the emitted light beam (105) into a first light beam (105) and a second light beam (106), the first light beam (105) being incident on the first track (302), the second light beam (106) being incident on the second track (302), light (105) diffracted from the first track (302) being incident on the first optical detector (18), (103), or (400) with detector elements (404), (405), and (406), light (106) diffracted from the second track (302) being incident on the second optical detector (18), (103), or (400) with detector elements (404), (405) and (406), (see fig. 1, column 1, lines 24-67, fig. 2, fig. 3, column 3, lines 27-66, fig. 4, column 4, lines 5-41).

Claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee et al (US 2003/0010906 A1).

As to claim 1, Lee et al disclose a quasi-monochromatic light source (302) disposed on a surface of a planar substrate (304) facing the encoder scale (307); a plurality of optical detectors (303), (312), (314) and (309) disposed on the surface of the substrate (303) at respective locations defining respective optical paths between the optical detectors (303), (312), (314) and (309) and respective tracks (308), (309) and (310) of the encoder scale (307); and an optical wavefront dividing element (504) disposed between the substrate (304) and the encoder scale (307), the optical wavefront dividing element (504) being operative to divide an incident light beam (305) and (503) produced by the light source (302) and (501) into a plurality of diffracted light beams (305), (306), (503) each diffracted light beam (305), (306) and (504) being directed toward a respective track of the encoder scale (307) at a respective angle so as to be reflected from the respective track (308), (309), and (310) along the optical path to the respective detector (312), (314), and (316), (see fig. 1, paragraph [0039], lines 1-7, fig. 3(a), paragraph [0056], lines 1-17, fig. 3(b), paragraph [0057], lines 1-16, fig. 5(a), paragraph [0061], lines 1-10).

As to claim 2, Lee et al disclose the quasi-monochromatic light source (302) comprises a vertical cavity surface emitting laser (VCSEL), (see fig. 3(a), paragraph [0056], lines 1-18).

As to claim 3, Lee et al disclose the quasi-monochromatic light source (302) emits an expanding cone of light (305), (see fig. 3(a), paragraph [0056], lines 1-18).

As to claim 4, Lee et al disclose the plurality of optical detectors (303), (312), (314), and (316) include two optical detectors (303) disposed on opposite sides of the light source (302), (see fig. 3(a), [0056], lines1-18).

As to claim 5, Lee et al disclose wavefront dividing element comprises a diffractive optical element (DOE) (504) and (604) disposed on a second substrate, (see fig. 5(a), paragraph [0061], lines 1-11, fig. 6(a), paragraph [0056], 1-14).

As to claim 6, Lee et al disclose DOE (diffractive optical element) (504) and (604) comprises a layer of material having a thickness selected to introduce a substantially half-wave delay (t/2) derived from equation $\Phi(x) = 2''/\text{ٴ}F^{X2}$) in light (503) passing through the DOE (504), (see fig. 5(a), paragraph [0061], lines 1-11, paragraph [0062], lines 1-12).

As to claim 7, Lee et al disclose the DOE (504) comprises a grating (506) having a square wave profile, (see fig. 4(c), paragraph [0059], lines 1-7fig. 5(a), paragraph [0061], lines 1-15, paragraph [0062], lines 1-12,).

As to claim 8, Lee et al disclose the DOE (504) comprises a grating (506) having a triangle wave profile (414), (see fig. 4(b), paragraph [0059], lines 1-7, fig. 5(a), paragraph [0061], lines1-11, fig. 5(b), paragraph [0062]), lines 1-12).

As to claim 9, Lee et al disclose DOE (504) comprises a grating (506) having a sine wave profile (410), (see fig. 4(a), paragraph [0061], lines 1-7, fig. 5(a), paragraph [0061], lines 1-11, fig. 5(b), paragraph [0062]), lines 1-12)..

As to claim 10, Lee et al disclose the second substrate further includes a plurality of windows, each window (504) lying along a corresponding one of the optical paths

(503) between the tracks (308), (309), and (310) on the encoder scale (307) and the detectors (312), (314), and (316), (see fig. 3(a), paragraph [0059], lines 1-18, fig. 5(a), paragraph [0061], lies 1-14, paragraph [0062], lines 1-12).

As to claim 11, Lee et al disclose a second substrate comprises a substantially optically transparent material (505) having a low coefficient of thermal expansion, (see fig. 5(a), paragraph [0062], lines 1-12).

As to claim 12, Lee et al disclose the second substrate is coated with optically transparent material (505) having an index of refraction n different from that of air, (see fig. 1, paragraph [0044], lines 1-9, paragraph [0046], lines 1-14, fig. 7(a), paragraph [0070], lines 1-6, fig. 7(b), paragraph [0071], lines 1-8, fig. 8(a) - fig. 8(c), paragraph [00075], lines 1-9, fig. 9(a), paragraph [0079], lines 1-14).

As to claim 13, Lee et al disclose the optically transparent material comprises a dielectric material (307), (see fig. 3(a), paragraph [0056], lines 1-18, fig. 8(a) – 8(c), paragraph [0074], lines 1-10, paragraph [0075], lines 1-9, fig. 9(a), paragraph [0079], 1-14).

As to claim 14, Lee et al disclose dielectric material (307) has a refractive index close to the refractive index of the second substrate, (see fig. 3(a), lines 1-17, fig. 9(a), paragraph [0079], lines 1-14).

As to claim 15, Lee et al disclose a sensor head (304) including a substrate and beam divider, the beam divider including an optical wavefront dividing element (504), the substrate having a light source (302) and (501) first and second optical detectors (303), and (507) disposed thereon; an encoder scale (307) including first and second

tracks (308), (309), and (310), the encoder scale (307) being disposed opposite the sensor head (304) with the beam divider (504) therebetween such that a light beam (305) or (503) emitted by the light source (302) or (501) is incident on the wavefront dividing element (504), the wavefront dividing element (504) being operative to divide the incident beam (305) or (503) into first and second beams (305), (306), and (503) being substantially incident on the first and second tracks (308), (309, and (310) of the encoder scale (307) respectively, light from the first beam (305) or (503) being reflected and diffracted by the first track to the first optical detector (303) and (507) with detector elements (312), (314) and (316) and light from the second beam (306) or (503) being reflected and diffracted by the second track (308), (309) and (310) to the second optical detector (303) and (507) with detector elements (312), (314), and (316); and a signal processor operative to interpret signals from the first and second detectors (303) and (507) with detector elements (312), (314), and (316), (see fig. 3(a), paragraph [0057], lines 1-15, fig. 5(a), paragraph [0061], lines 1-11), paragraph [0062], lines 1-12).

As to claim 16, Lee et al disclose a sensor head (304) including a substrate having a light source (302) or (501) and first and second optical detectors (303) and (507) with detector elements (312), (314), and (316) disposed thereon; and encoder scale (307) including first and second tracks (308), (309) and (310); and a wavefront dividing element (504) disposed between the sensor head (304) and the encoder scale (307), the wavefront dividing element (504) being operative to divide an incident light beam (305) and (503) emitted by the light source (302) and (501) into first and second beams (305), (306), and (503), the first beam (305) or (503) being incident on the first

track (308), (309) or (310) of the encoder scale (307), the second beam (306) being incident on the second track (308), (309), or (310) of the encoder scale (307), light from the first beam (305) or (503) being reflected and diffracted by the first track (308), (309), or (310) to the first optical detector (303) or (507), light from the second beam (306) being reflected and diffracted by the second track (308), (309) or (310) to the second optical detector (303), (507), (312), (314), and (316), (see fig. 3(a), paragraph [0056], lines 1-17, fig. 3(b), paragraph [0057], lines 1-15, fig. 5(a), paragraph [0061], lines 1-14, paragraph [0062], lines 1-12).

As to claim 17, Lee et al disclose a wavefront dividing element (504) is disposed on a substrate of the beam divider (506) disposed between sensor head (304) and the encoder scale (307), (see fig. 3(a), paragraph [0056], lines 1-17, fig. 5(a), paragraph [0061], lines 1-14, paragraph [0062], lines 1-12).

As to claim 18, Lee et al disclose the substrate of the beam divider (506) is fixed relative to the substrate of the sensor head (304), (see fig. 3(a), paragraph [0056], lines 1-17, fig. 5(a), paragraph 1-14, paragraph [0062], paragraph 1-13).

As to claim 19, Lee et al disclose the substrate of the beam divider (506) and the substrate of the sensor head (304) are fixed into a single monolithic construction, (see fig. 3(a), paragraph [0056], lines 1-17, fig. 5(a), paragraph [0061], lines 1-14, paragraph [0062], lines 1-12).

As to claim 20, Lee et al disclose the encoder (301) including a scale (307), the scale (307) being movable relative to the sensor head (304) along a first axis, a distance (Z_Φ) or (Z_1) between the scale (307) and the sensor head (304) as measured in

a direction substantially perpendicular to the first axis being substantially constant, the encoder (301) generating a signal representative of a position of the scale (307) relative to the sensor head (304), the scale (307) including a first track and a second (308), (309) and (310), the sensor head (304) comprising a substrate, a light source (302) or (5012), a first optical detector (303) and (507) with detector element (312), (314), and (316), a second optical detector (303), (507), with detector elements with detector elements (312), (314), and (316), and a beam divider (506) including an optical wavefront dividing element (504), the light source (302) and (501) being disposed on the substrate, the beam divider (506) being spaced apart from and fixed relative to the substrate, an emitted light beam (305) and (503) emitted from the light source (302) and (501) being incident on the wavefront dividing element (504), the wavefront dividing element (504) dividing the emitted light beam (305) and (503) into a first light beam (305) and a second light beam (306), the first light beam (305) being incident on the first track (308), (309) and (310), the second light beam (306) being incident on the second track (308), (309) and (310), light (305) diffracted from the first track (308), (309) and (310) being incident on the first optical detector (303), (507) with detector elements (312), (314), and (316), light (306) diffracted from the second track (308), (309) and (310) being incident on the second optical detector (303), (503), with detector elements (312), (314) and (316), (see fig. 1, paragraph [0039], lines 1-7, fig. 3(a), paragraph [0056], lines 1-17, fig. 3(b), paragraph [0057], lines 1-15, fig. 5(a), paragraph [0061], lines 1-11, paragraph [0062], lines 1-12).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Don Williams whose telephone number is 571-272-8538. The examiner can normally be reached on 8:30a.m. to 5:30a.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dave Porta can be reached on 571-272-2444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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